NuFlo

Clif Mock

CD30A (115VAC) Sampler Drive

User Manual

INTRINSICALLY SAFE FOR USE IN HAZARDOUS ENVIRONMENTS. CLASS I, DIV 1, GROUP D

NuFlo *Measurement Systems*
A NuFlo Technologies Company

Manual No. 20165024, Rev. B

© 2004 NuFlo Technologies, Inc. All information contained in this publication is confidential and proprietary property of NuFlo Technologies, Inc. Any reproduction or use of these instructions, drawings, or photographs without the express written permission of an officer of NuFlo Technologies, Inc. is forbidden.

All Rights Reserved.
Printed in the United States of America.

Manual No. 20165024, Rev. B
October 2004

Table of Contents

Description **1**

Pulse Input Scaling 2

Repeat Time Scaling 2

Installation and Wiring **3**

Pre-Test Procedure 4

Repeat Mode Check-Out 4

External Input Pulse Mode Check-Out 4

Sample Probe and CD30A Check-Out 5

Motor Control Operation **5**

Command Board Functions 5

Power Board Functions 6

Interconnect Board Functions 6

Repairs **7**

Bill of Materials **7**

Sampler Drive Schematic **8**

Description

The CD30A Control and Drive Assembly (Part No. 50132381535) is engineered specifically for use with the True-Cut C-Series sample probes. The assembly is certified by CSA as intrinsically safe for use in hazardous environments (Class I, Div. 1, Group D).

It comprises the following components:

- a motor speed control that provides both pulse input (flow-proportional) and repeat (time-proportional) control of the sample probe. When a "start" pulse is received at the CD30A control card input, the probe is rotated 180 degrees to capture and discharge a single 1.5-ml isokinetic sample. On a horizontal line, the probe is stopped in the closed position, while on a vertical line, the probe is stopped in the open position.
- a 9VDC gear motor with a gear ratio of 150:1
- a cam with two high points located opposite each other, mounted on the gear motor output shaft.
- a proximity switch mounted in the hub assembly opposite the cam. When a high point on the cam is opposite the proximity switch, the PROX ("Hold") LED will be illuminated. This signal indicates the sample probe is at the stop and "hold" position.
- a coupling, jam nut, and hub, which allow the CD30A Control and Drive Assembly to be mounted directly to the C-Series sample probe. No brackets or supports are required, but they are advisable on pipelines with some vibrations.
- an explosion-proof housing, which encloses the complete assembly. Two ¾-in. NPT holes allow connection of the 115VAC, 50/60 Hz line power and input pulse (for flow proportional sampling). A ½-in. breather plug is installed on one side of the enclosure, and a ½-in. conduit plug is installed on the opposite side of the enclosure.

The motor speed control unit allows the user to select pulse input (flow-proportional) or repeat (time-proportional) control of the sample probe (Figure 1).

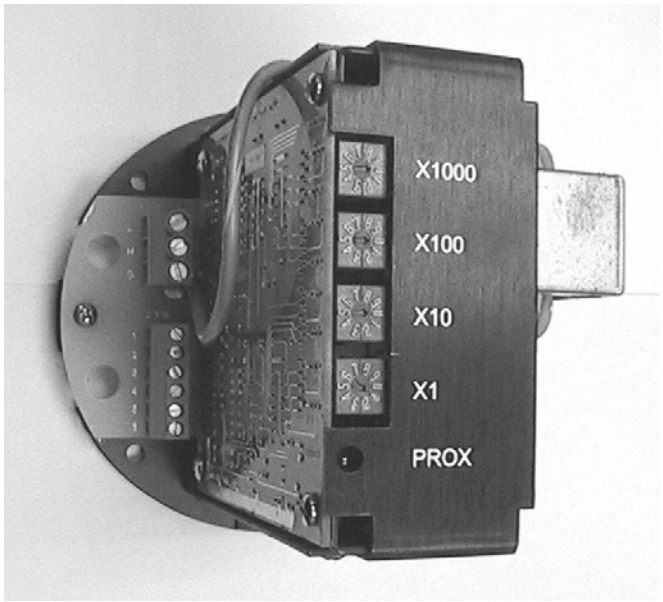


Figure 1—Red switches labeled X1000, X100, X10, and X1 allow selection of pulse input (flow proportional) or repeat (time-proportional) control of the sample probe.

Pulse Input Scaling

The best flow pulse input is an open collector NPN transistor or open drain FET transistor.

If a relay contact is used as the flow pulse input, it must have a low-level electronic signal rating. A power-rated contact will not work reliably over time.

If a flow pulse input with source current capability is used (a signal that has one logic level referenced to DC voltage and the other logic level referenced to common), the voltage requirements are:

- Maximum DC peak voltage: 24 VDC
- Minimum DC peak voltage: 10 VDC

The four pulse scaling switches labeled X1000, X100, X10, and X1 (Figure 1) allow selection of the desired number of flow pulses per sample. Some switch setting examples are shown below.

Pulse Input Switch Setting Examples

X1000	X100	X10	X1	Pulses Per Sample
0	0	0	1	1
0	0	1	0	10
0	1	0	0	100
1	0	0	0	1,000
1	2	3	4	1,234
9	9	9	9	9,999

An internal sample command is generated when the CD-30A sample command board counts a number of flow pulses equal to the number set on the switches.

Repeat Time Scaling

The repeat mode utilizes a 1-Hz clock signal in lieu of the external flow proportional pulses to pace the sample probe.

The X1000, X100, X10, and X1 switches allow direct repeat time settings in seconds. Some repeat time switch setting examples are shown below.

Repeat Time Switch Setting Examples

Switch Settings				Time Between Samples
X1000	X100	X10	X1	
0	0	0	3	3 Seconds (Max. Time)
0	0	1	0	10 Seconds
0	1	0	0	100 Seconds
1	0	0	0	1,000 Seconds
1	2	3	4	1,234 Seconds
9	9	9	9	9,999 Seconds

The repeat mode (time-proportional sampling) can be used as a test mode and a backup for the external input pulse mode (flow-proportional sampling).

Installation and Wiring

The CD30A mounts directly to the C-Series sample probe via the DC-2 coupling. The DC-2 coupling should be hand-tightened only to ensure that the internal retaining ring is not pushed out of its groove. If the DC-2 coupling is over-tightened at the CD30A hub, the motor shaft will not engage the DC-1 (not shown) coupling on the probe.

Use the following steps to install field wiring to the CD30A-115VAC:

1. Connect 115VAC, 50/60 Hz power to 1TB-L.
2. Connect the neutral wire to 1TB-N.
3. Connect the ground wire to 1TB-G (Figure 2).
4. Select the pulsed or repeat mode of operation as follows:
   a. Connect jumper wire between 2TB-5 and 2TB-6 to select the repeat mode (Figure 2).
   b. Connect jumper wire between 2TB-5 to 2TB-4 to select the pulsed mode of operation (Figure 2).

When the pulsed mode is selected, the flow pulse input must be wired to 2TB-3 (signal) and 2TB-2 (common). If an electronic square wave is utilized, it must have a pulse amplitude of 10VDC. A 5VDC square wave will not work.

The jumper between 2TB-1 and 2TB-2 adds filter capacitance to the flow pulse input circuit. This jumper must be in place for input flow pulse rates up to 10Hz. This jumper must be removed when high frequency flow rate signal inputs (10 to 1000 Hz) are to be utilized.

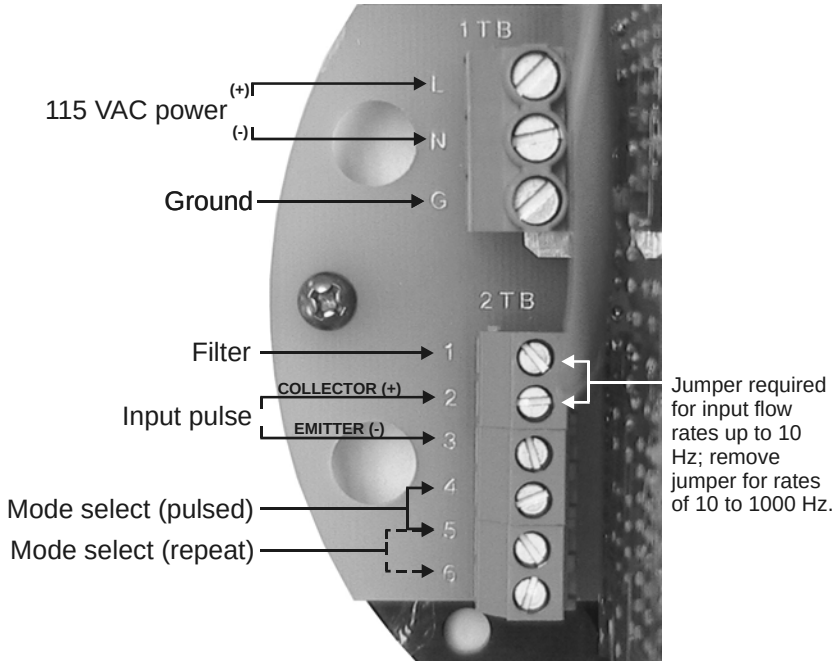


Figure 2—Field wiring of CD30A (115VAC) assembly, 1TB and 2TB

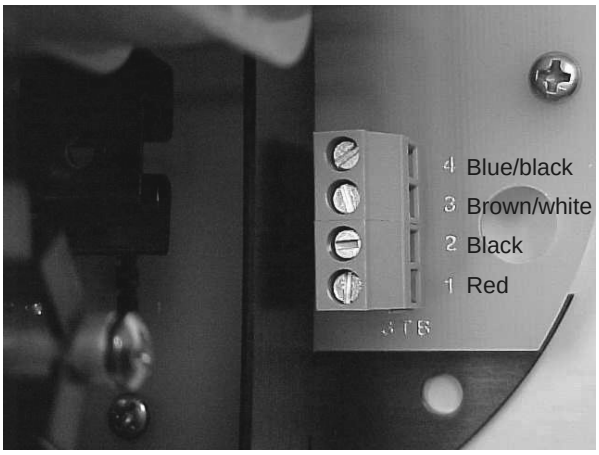


Figure 3—Terminal block 3TB on interconnect board (prewired at factory)

Start-Up Procedure

The start-up procedure consists of four steps: a pretest, a repeat-mode checkout, an external input pulse mode checkout, and a sample probe/control drive checkout. Each of these is described below.

Pre-Test Procedure

1. Disconnect the CD30A control and drive assembly from the sample probe.
2. Connect the jumper between 2TB-5 to 2TB-6 to select the repeat mode.
3. Set the X1 switch to “5”.
4. Set the X10, X100, X1000 switches to “0”. This sets a 5-second repeat cycle time.
5. Connect a pushbutton switch (customer-supplied) between 2TB-2 and 2TB-3 for test purposes. Make sure the filter jumper is in place between 2TB-1 and 2TB-2.

Repeat Mode Check-Out

1. Apply 115VAC input power to the CD30A.
2. Verify that the PROX (“Hold”) LED is on when the motor is not turning.
3. After the CD30A off delay time, verify that the output shaft turns in a CLOCKWISE (CW) direction as you look at the shaft. The sample probe will then be rotated COUNTERCLOCKWISE (CCW) when the CD30A is connected to it. If the direction of motor rotation is wrong, swap the motor armature leads at 3TB-1 and 3TB-2 (Figure 4).
4. Verify that the CD30A output shaft rotates 180 degrees and stops after each off delay period. It should take about 2.5 seconds for the motor to rotate 180 degrees and stop.
5. The PROX (“Hold”) LED should be off while the motor is running and turned on when the motor stops.

External Input Pulse Mode Check-Out

1. Disconnect AC input power from the CD30A.
2. Connect the jumper between 2TB-4 to 2TB-5 to select the external input pulse mode.
3. Set switch “X1” to 1.

4. Set the X1000, X100, and X10 switches to "0." This selects a sample output for each input pulse.
5. Reapply AC power to the CD30A.
6. Push the pushbutton switch to simulate an external input pulse.
7. Verify that the CD30A output shaft rotates 180 degrees for each external input pulse.

Note—Any internal coincidence pulses that provide the next "start" command for the CD30A must occur when the CD30A is stopped and the PROX ("Hold") LED is on. The maximum valid flow proportional sampling rate is 2.5 seconds per sample (24 samples/min).

Sample Probe and CD30A Check-Out

1. Disconnect AC power from the CD30A.
2. Verify that jumper is installed to select the desired mode of operation.
3. Mount the CD30A to the sample probe and hand-tighten the DC-2 coupling.
4. Verify that the product line is full and pressurized.
5. Hold a 100-ml graduated beaker (or other applicable measuring device) under the probe's discharge port and collect 10 samples. Each sample should be 1.5-ml in size; the total volume for 10 samples, therefore, should be 15 ml.

Motor Control Operation

The CD30A motor control assembly consists of a command board, motor drive, and interconnect board mounted to a bracket, which in turn is mounted to the back of the CD30A gear motor. All field connections are to terminal blocks 1TB and 2TB. The motor and proximity switch connections are made at the factory to terminal block 3TB on the interconnect board.

Command Board Functions

The CD30A command board performs the following functions:

- Components C4, R3, CR1, and a U3 gate provide a 100-msec power-up reset.
- A 1,024 Hz time base is generated by R8, R9, C11, and a U2 gate. U6 is a divide-by-1024 counter, which produces the 1 Hz repeat mode time base.
- An input filter circuit R11, R12, CR4, CR5, C6 and a U3 gate buffer incoming pulses from an external flow-measuring device. An extra filter capacitor, C13, is selected by a jumper between 2TB-1 and 2TB-2 for low-frequency contact inputs.
- An input filter circuit comprised of R7, C7, CR3, CR6, and a U3 gate conditions the repeat or pulsed mode signal prior to the signal being fed to the pulse scaling circuitry.
- A frequency divider circuit features switch selection of the divide-by factor from 1 to 9,999 via SW1 (X1), SW2 (X10), SW3 (X100), and SW4 (X1000)

  The divider circuit utilizes dual decade counters U1 and U2 and diode packages DA1, DA2, DA3, and DA4.

  Co-incidence between the switch setting and decade counters U1 and U2 produces a logical 1 signal at the U3 gate input connected to pull-up resistor R2. The co-incidence pulse is filtered by R5 and C2 and applied to a U4 gate, which provides the logical, or function with the power-up-reset (POR)

signal prior to application to the dual decade counter reset lines. The start pulse also sets the RUN/STOP latch U5.

- When set by a start pulse, the RUN/STOP latch U5A outputs the speed command voltage to the summing point control amplifier U8A.
- Amplifier U8B provides current feedback to the summing point control amplifier U8A.
- Resistor R26 provides armature voltage feedback to the summing point control amplifier U8A.
- DS1 is the “PROX” LED indicator.
- U7A and U7B are the proximity switch amplifiers.

  Note that the voltage across the proximity switch (3TB-3 to 3TB-4 on the power board) will be nominally +8 VDC when the proximity switch is sensing metal and +4 VDC when the proximity switch is sensing an absence of metal.
- Latch U5B outputs a 500-msec one-shot pulse to reset the RUN/STOP latch U5A when the proximity switch first senses a high point on the cam.DS1 is the current limit LED indicator.

Power Board Functions

The CD30A power board provides the following functions:

- Fuse F1 (1-amp, type AGC) provides short circuit protection. It will open if there is a short in the primary or secondary current of transformer T1, or if secondary current is excessive.
- Transformer T1 converts the 115 VAC input to 14 VAC secondary voltage. This transformer has a 98° Celsius thermal fuse wired in series with the primary to assure the maximum transformer class B insulation temperature is never reached.
- Diodes CR1, CR2, CR3, and CR4 provide full-wave rectified DC voltage to be used to drive the motor and to make the regulated +10 VDC.
- Transistor circuits including Q2, Q3, and Q4 provide the output drive control for the gear motor, which has a 0 to 6.3 VDC armature and permanent magnet field.
- Power FET Q5 is on when the RUN/STOP latch outputs a motor stop command. Q5 provides electronic braking of the motor to minimize coast past the desired probe stopping point.
- Resistor R1 is the current-sensing resistor for the current-limit circuit.
- Regulator Q1 provides +10 VDC for the sample command card.

Interconnect Board Functions

The CD30A interconnect board performs the following functions:

- Provides separate wiring terminals for power and signal connections. “Feed-through” holes in front of the power and signal terminal blocks allow for routing of power cable and signal wires. These “feed through” holes keep the power and signal wires separate and also help prevent wires from contacting the cover, which could cause abrasion of the insulation.
- Provides a terminal block and feed-through hole for the motor and proximity switch wires.
- Routes all external signals to connector J1.
- Provides a mounting base for the replaceable electronics assembly consisting of the motor drive and sample command boards.

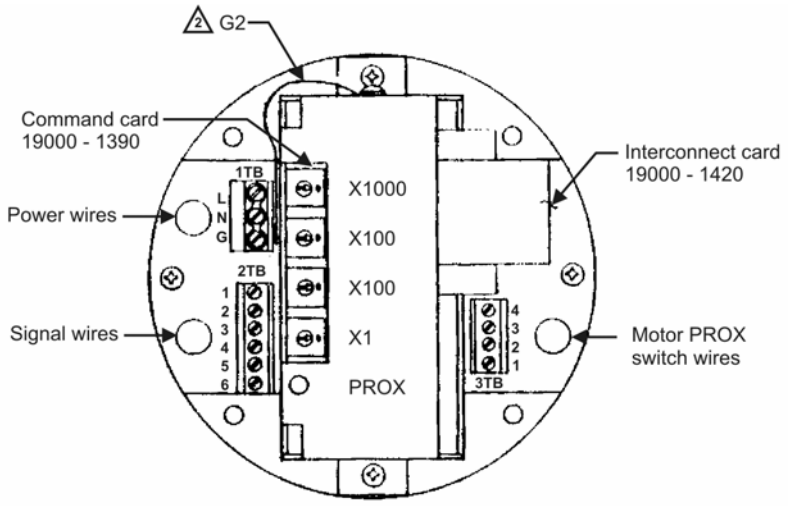
Repairs

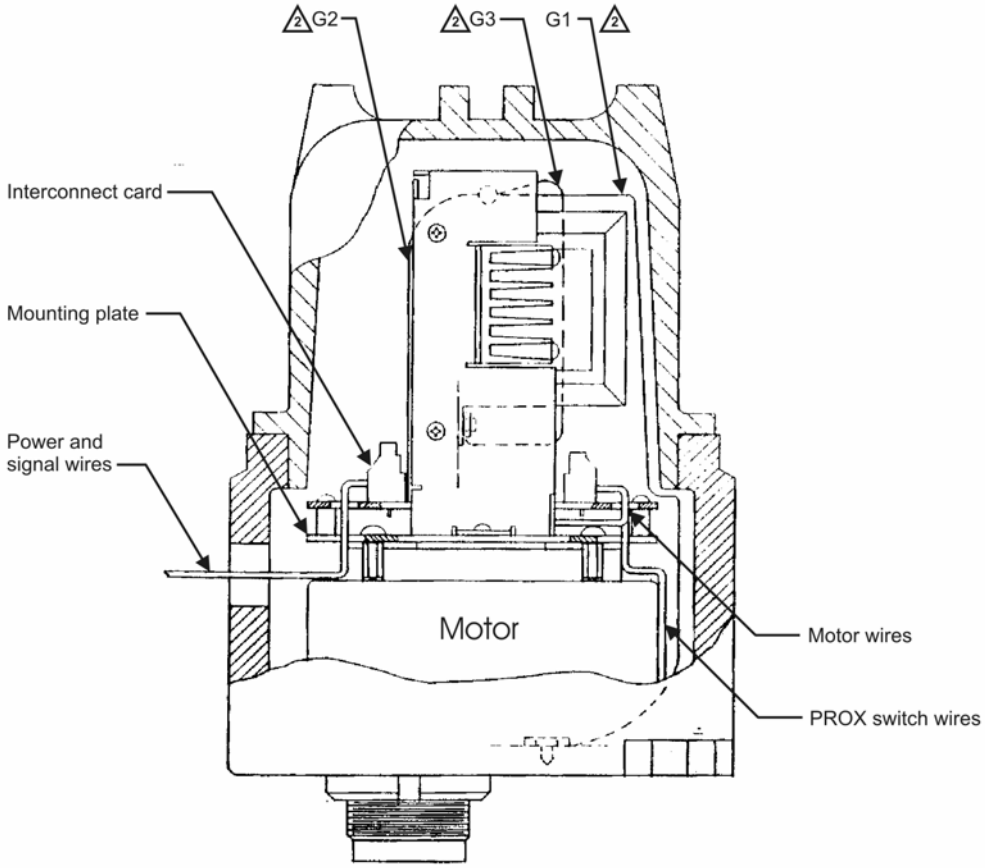
If the CD30A assembly fails to perform as described in this manual, consult a NuFlo Measurement Systems factory for assistance and/or repairs.

Important—Attempts to repair the assembly without consulting the NuFlo Measurement Systems will invalidate product warranties.

CD30A-115VAC Assembly (Part No. 50132381535) Parts List

ITEM	QTY	CONTROL NO.	DESCRIPTION
1	1	50142304856	ENCLOSURE
2	1	50142381633	SPEED CONTROL, 115VAC
3	1	50142307700	MOTOR, CS/CD DRIVE
4	1	50142382006	HUB ASSEMBLY, CD DRIVE
5	1	50142200170	JAM NUT, CS/CD DRIVE
6	1	50142150932	DRIVE COUPLING ASSY, DC-2
7	1	50142307695	DRIVE SHAFT
8	1	50142381667	COUPLING, CAM/MOTOR ASSEMBLY
9	1	50142309906	PROXIMITY SWITCH, EI-08-01-NACS
10	1	50142307686	ADAPTER PLATE
11	1	50142304632	PLUG, 1/2", CONDUIT
12	1	50142307696	SNAP RING
13	1	50142382015	TAG, ELECTRICAL, CD-30A
14	4	50025400765	DRIVE SCREW, 2 x 3/16"
15	11	50142307693	BINDER HD SCREW, #8-32NC x 1/2" LG
16	11	50142307694	WASHER HUB SCREW, #8
17	1	50142304642	BREATHER, 1/2" PLUG
18	1	50142200109	CAUTION TAG
20	1	50142304858	HUMISORB PACKET, #107HX 4 x 4





⚠1 **Electrical Warning**
Route wires as shown in slots and hours provided in mounting plate and interconnect card to prevent electrical shorting to enclosure.

⚠2 Grounding wires G1, G2, and G3 to be 14 AWG min.
G1 - green lug on the housing to the lug on the CD30A bracket.
G2 - soldered internally to ground terminal on 1TB and other end to the lug on CD30A bracket.
G3 - transformer housing to the lug on the CD-30A bracket.

WARRANTY - LIMITATION OF LIABILITY: Seller warrants only title to the products, software, supplies and materials and that, except as to software, the same are free from defects in workmanship and materials for a period of one (1) year from the date of delivery. Seller does not warranty that software is free from error or that software will run in an uninterrupted fashion. Seller provides all software "as is". THERE ARE NO WARRANTIES, EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS OR OTHERWISE WHICH EXTEND BEYOND THOSE STATED IN THE IMMEDIATELY PRECEDING SENTENCE. Seller's liability and Buyer's exclusive remedy in any case of action (whether in contract, tort, breach of warranty or otherwise) arising out of the sale or use of any products, software, supplies, or materials is expressly limited to the replacement of such products, software, supplies, or materials on their return to Seller or, at Seller's option, to the allowance to the customer of credit for the cost of such items. In no event shall Seller be liable for special, incidental, indirect, punitive or consequential damages. Seller does not warrant in any way products, software, supplies and materials not manufactured by Seller, and such will be sold only with the warranties that are given by the manufacturer thereof. Seller will pass only through to its purchaser of such items the warranty granted to it by the manufacturer.

NuFlo
Measurement Systems

NuFlo Measurement Systems
14450 John F. Kennedy Blvd.
Houston, TX 77032
www.nuflotech.com

North America:
800-654-3760
281-582-9500 (Houston)
877-891-6540 (Calgary)

UK:
44-1243-826741

Singapore:
65-6737-0444